

## AMENDMENTS TO THE CLAIMS

Please add new claims 50-55.

Please amend the claims as follows:

Claims 1-25 (Canceled)

26. (Currently Amended) A biological assay device ~~produced by a method~~ comprising the steps of:

(i) an electrically conductive substrate, wherein the electrically conductive substrate is a microneedle or a microelectrode; and,

(ii) a layer of sol-gel deposited on at least one surface of the electrically conductive substrate.

~~(a) providing an acidified sol suspension;~~

~~(b) at least partially neutralizing the acidified sol suspension to form a neutralized sol suspension;~~

~~(c) contacting an electrically conductive surface with the neutralized sol suspension, wherein the electrically conductive substrate is a microneedle or a microelectrode; and~~

~~(d) applying an electrical potential to the electrically conductive surface to cause a layer of sol-gel to form on the surface of the electrically conductive surface.~~

27. (Previously Presented) A biological assay device comprising:

(i) an electrically conductive substrate, wherein the electrically conductive substrate is a microneedle or a microelectrode; and,

(ii) a sol-gel comprising one or more biological materials.

28. (Previously Presented) The biological assay device of claim 27, wherein the sol-gel is obtained from a mixture comprising a mercaptan-containing silane and/or a bisfunctional silane.

29. (Previously Presented) The biological assay device of claim 26 further comprising a potentiometer.

30. (Canceled)

31. (Currently Amended) The biological assay device of claim 26, ~~further comprising the step of adding wherein the sol-gel comprises~~ one or more biological materials ~~to the neutralized sol suspension, prior to applying the electrical potential to the electrically conductive surface (step C).~~

32. (Previously Presented) The biological assay device of claim 31, wherein the one or more biological materials is an enzyme, antibody, fragment of an antibody, nucleic acid, polysaccharide, oligosaccharide, biomimetic polymers, virus, microorganism or a whole cell.

33. (Previously Presented) The biological assay device of claim 27, wherein the one or more biological materials is an enzyme, antibody, fragment of an antibody, nucleic acid, polysaccharide, oligosaccharide, biomimetic polymers, virus, microorganism or a whole cell.

34. (Previously Presented) The biological assay device of claim 32, wherein the enzyme is xanthine oxidase, glucose oxidase, lactate oxidase, cholesterol oxidase, galactose oxidase, glutamate oxidase, horse radish peroxidase, polyphenol oxidase, D-fructose dehydrogenase, L-glutamate dehydrogenase, alcohol dehydrogenase (such as methanol dehydrogenase), urease, uricase, lactate dehydrogenase, glutamic pyruvic transaminase, creatinase, sarcosine oxidase, glutaminase, nucleoside phosphorylase, ascorbate oxidase, cytochrome C oxidase, adenosine deaminase, D- or L-amino acid oxidase, tyrosinase or choline dehydrogenase or a combination thereof.

35. (Previously Presented) The biological assay device of claim 33, wherein the enzyme is xanthine oxidase, glucose oxidase, lactate oxidase, cholesterol oxidase, galactose oxidase, glutamate oxidase, horse radish peroxidase, polyphenol oxidase, D-fructose dehydrogenase, L-glutamate dehydrogenase, alcohol dehydrogenase (such as methanol dehydrogenase), urease, uricase, lactate dehydrogenase, glutamic pyruvic transaminase, creatinase, sarcosine oxidase, glutaminase, nucleoside phosphorylase, ascorbate oxidase, cytochrome C oxidase, adenosine

deaminase, D- or L-amino acid oxidase, tyrosinase or choline dehydrogenase or a combination thereof.

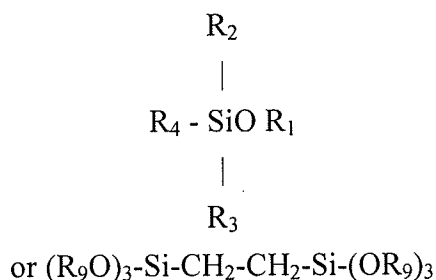
36. (Previously Presented) The biological assay device of claim 32, wherein two or more enzymes are used.

37. (Previously Presented) The biological assay device of claim 33, wherein two or more enzymes are used.

38. (Previously Presented) The biological assay device of claim 26, wherein the sol comprises a sol of alkoxysilane, alumina, colloidal metal hydroxide, ceramic oxide or zirconia.

39. (Previously Presented) The biological assay device of claim 27, wherein the sol comprises a sol of alkoxysilane, alumina, colloidal metal hydroxide, ceramic oxide or zirconia.

40. (Currently Amended) The biological assay device of claim 38, wherein the sol has the general formula:

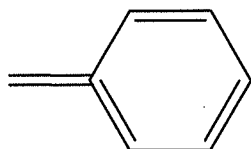


where:

$R_1$  = straight chain, branched chain, cyclic, non-cyclic, saturated or non-saturated, substituted or non-substituted alkyl; substituted or non-substituted aryl;  $-NR_5$ ; and  $-COR_6$ ; preferably containing 1, 2, 3, 4, 5 or 6 carbons;

$R_2$ ,  $R_3$  and  $R_4$  are independently selected from; straight chain and branched chain, cyclic or non-cyclic, saturated or non-saturated alkyl;  $-COR_6$ ;  $-O$ -alkyl; and  $-O-COR_6$ ;  $-R_7R_8$ ;  $R_7N(R_6)_2$  and  $R_7NHR_6R_8$ ; preferably containing 1, 2, 3, 4, 5, or 6 carbon atoms;

$R_5$  = branched or non-branched cyclic or non-cyclic, saturated or non-saturated alkyl;  
or

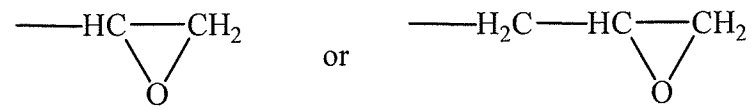
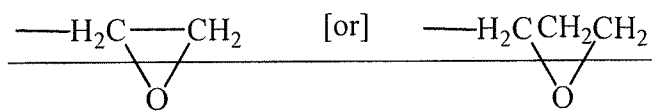


, preferably containing 1, 2, 3, 4, 5, or 6 carbon atoms;

$R_6$  =  $C_1$  to  $C_3$  alkyl;

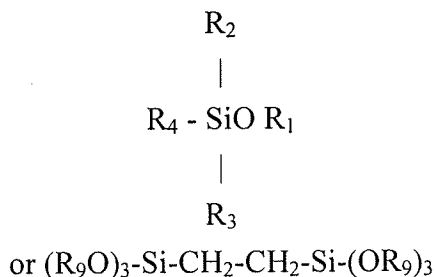
$R_7$  =  $C_1$  to  $C_6$  alkyl, especially  $C_1$ ,  $C_2$  or  $C_3$  alkyl;

$R_8$  = Epoxy,  $-NH_2$  or  $-SH$ ; especially



$R_9 =$       Straight or branched  $C_1$  to  $C_6$  alkyl.

41. (Currently Amended) The biological assay device of claim 39, wherein the sol has the general formula:

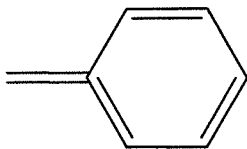


where:

$R_1$  = straight chain, branched chain, cyclic, non-cyclic, saturated or non-saturated, substituted or non-substituted alkyl; substituted or non-substituted aryl;  $-NR_5$ ; and  $-COR_6$ ; preferably containing 1, 2, 3, 4, 5 or 6 carbons;

$R_2$ ,  $R_3$  and  $R_4$  are independently selected from; straight chain and branched chain, cyclic or non-cyclic, saturated or non-saturated alkyl;  $-COR_6$ ;  $-O$ -alkyl; and  $-O-COR_6$ ;  $-R_7R_8$ ;  $R_7N(R_6)_2$  and  $R_7NHR_6R_8$ ; preferably containing 1, 2, 3, 4, 5, or 6 carbon atoms;

$R_5$  = branched or non-branched cyclic or non-cyclic, saturated or non-saturated alkyl;  
or

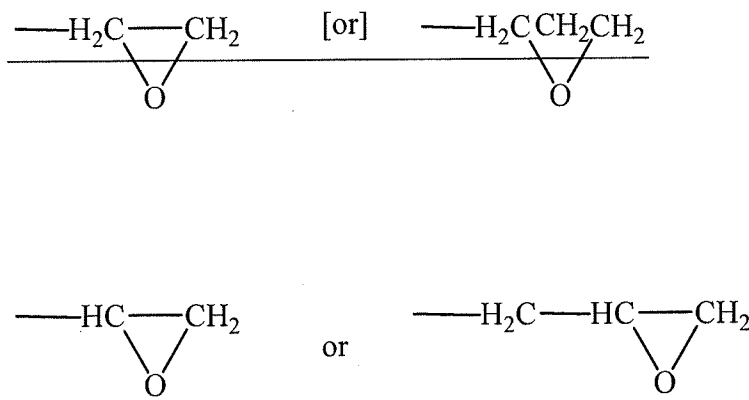


, preferably containing 1, 2, 3, 4, 5, or 6 carbon atoms;

$R_6$  =  $C_1$  to  $C_3$  alkyl;

$R_7$  =  $C_1$  to  $C_6$  alkyl, especially  $C_1$ ,  $C_2$  or  $C_3$  alkyl;

$R_8$  = Epoxy,  $-NH_2$  or  $-SH$ ; especially



R<sub>9</sub> = Straight or branched C<sub>1</sub> to C<sub>6</sub> alkyl.

42. (Previously Presented) The biological assay device of claim 40, wherein the sol is methyltrimethoxysilane (MeTMOS) or tetramethylsilicate (TMOS).

43. (Previously Presented) The biological assay device of claim 41, wherein the sol is methyltrimethoxysilane (MeTMOS) or tetramethylsilicate (TMOS).

44. (Currently Amended) The biological assay device of claim 26, further comprising ~~adding~~ a silane coupling agent.

45. (Currently Amended) The biological assay device of claim 44, wherein the silane coupling agent comprises ~~comprising incorporating~~ functionalized or non-functionalized APTEOS ~~into the neutralized sol suspension.~~

46. (Previously Presented) The biological assay device of claim 45, wherein the APTEOS is functionalized with a ferrocene, gluconamide or a lactiobionic group.

47. (Previously Presented) The biological assay device of claim 27, further comprising a silane coupling agent.

48. (Previously Presented) The biological assay device of claim 47, further comprising functionalized or non-functionalized APTEOS
49. (Previously Presented) The biological assay device of claim 47, wherein the APTEOS is functionalized with a ferrocene, gluconamide or a lactiobionic group.
50. (New) The biological assay device of claim 26, wherein the microneedle or microelectrode is less than about 10 mm long.
51. (New) The biological assay device of claim 26, wherein the microneedle or microelectrode is from about 0.5 to about 2 mm long.
52. (New) The biological assay device of claim 26, wherein the microneedle or microelectrode is from about 10 to about 50  $\mu\text{m}$  in diameter.
53. (New) The biological assay device of claim 27, wherein the microneedle or microelectrode is less than about 10 mm long.
54. (New) The biological assay device of claim 27, wherein the microneedle or microelectrode is from about 0.5 to about 2 mm long.
55. (New) The biological assay device of claim 27, wherein the microneedle or microelectrode is from about 10 to about 50  $\mu\text{m}$  in diameter.